

SEVERITY OF ASTHMA IN RELATION TO THE BODY MASS INDEX IN SULAIMANI GOVERNORATE, IRAQ

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Abstract

Background and Objectives: Asthma and obesity have a considerable impact on public health and their prevalence has increased in recent years. The association between asthma severity and obesity has been increasingly established. The objective of this present study is to confirm the relationship between asthma severity and body mass index or obesity.

Patients and Methods: This cross sectional descriptive study was conducted at Allergy and Asthma center and Sulaimani Internal Teaching Hospital. One hundred patients (66 female and 34 male), aged between 16 - 79 years old who were previously diagnosed with asthma were included in this study. US dietary guideline was used to categorize body mass index groups. Asthma severity was classified according to the criteria of the global initiative for asthma guidelines in 2008. Statistical package for social science (version 21) was used for statistical analysis.

Results: The mean \pm standard deviation of body mass index and global initiative of asthma for asthma severity classification were 28.8 ± 7.3 and 4.1 ± 1.1 , respectively. The positive correlation coefficient was found between body mass index and asthma severity classification of global Initiative for Asthma ($r=0.252$). Therefore, this positive correlation was statistically significant ($p=0.011$) independent on sex and ages .The

coefficient of body mass index was 0.035. Thus, this means that for one value increase in body mass index, a 3.5% increase in Asthma severity class would be expected.

Conclusion: Obesity was positively correlated with asthma severity. This correlation suggests that obesity may be a potential modifiable risk factor for asthma exacerbation.

Keywords: asthma severity, obesity, body mass index, Sulaimani

Introduction

Asthma is one of the most common chronic lung diseases worldwide. It is characterized by recurrent respiratory symptoms, especially wheezing, shortness of breath, chest tightness, and coughing. These symptoms differ in intensity from person to person, and also wax and wane over time (Global asthma day, 2014). Asthma predominantly occurs in boys during childhood with a male-to-female ratio of 2:1. At puberty, the male-to-female ratio becomes 1:1; but after puberty, the asthma prevalence is greater in female compared to males (Burrows et al., 1999). Consequently, asthma has affected an estimated 300 million individuals worldwide. It is estimated that there may be an additional 100 million persons with asthma by year 2025. Also, it is worth mentioning that the World Health Organization has estimated that annually, 15 million disability-adjusted life-years were lost and 250,000 asthma deaths were reported worldwide (Masoli et al., 2004). The pathophysiology of asthma is complex and involves the following components: Airway inflammation, intermittent airflow obstruction, and bronchial hyper-responsiveness (National Heart, Lung, and Blood Institute, May 2008).

Diagnosis of Asthma

The diagnosis of asthma is based on clinical symptoms, physical examination, and pulmonary function test (Gjevre et al., 2006). Spirometry is recommended as the ideal method to establish a diagnosis of asthma. Improvements in Forced expiratory volume in first second (FEV1) within 10 minutes after inhalation of rapid-acting bronchodilator or reversibility in FEV1 indicates that a diagnosis of asthma is accepted as >12% (or >200ml) from pre-bronchodilator. Also, Peak Expiratory Flow (PEF) measurements can be an important aid in the diagnosis and monitoring of asthma. Therefore, PEF should be measured first in the morning before treatment is taken, when values are at their lowest, and lastly at night when values are usually higher. A 60 L/min (or >20% of pre-bronchodilator PEF) improvement after inhalation of a bronchodilator or a diurnal variation in PEF >20% suggests a diagnosis of asthma (Holohan et al., 2012).

Asthma Severity

The severity of asthma was classified according to the criteria of the 2008 global initiative for asthma (GINA). However, they are classified as intermittent, mild persistent, moderate persistent, and severe persistent.

Table 1. Steps of GINA classification

PEF Variability	PEF or FEV1	Symptoms/Night	Symptoms/Day	
< 20%	>= 80%	<= 2 times a month	< 1 time a week Asymptomatic and normal PEF between attacks	STEP 1 Intermittent
20-30%	>= 80%	> 2 times a month	> 1 time a week but < 1 time a day Attacks may affect activity	STEP 2 Mild Persistent
> 30%	60%-80%	> 1 time a week	Daily Attacks affect activity	STEP 3 Moderate Persistent
> 30%	<= 60%	Frequent	Continuous Limited physical activity	STEP 4 Severe Persistent

Treatment of Asthma

Stepwise Pharmacologic Therapy

Asthma medications should be added or deleted as the frequency and severity of the patient's symptoms changes (Global Strategy for Asthma Management and Prevention, 2014):

Steps 1 - Intermittent Asthma: A controller medication is not indicated. The reliever medication such as SABA is needed for symptoms.

Step 2 - Mild Persistent Asthma: Controller medication is a low-dose ICS. Alternatives include sodium cromolyn, nedocromil, and leukotriene receptor antagonist (LTRA)(Berridge, 2000) .

Step 3 - Moderate Persistent Asthma: Controller medication is either a low-dose ICS plus a LABA (combination medication preferred choice to improve compliance)(Nelson, 2001) or a medium-dose ICS. Alternatives include a low-dose ICS plus either a LTRA, theophylline, or zileuton.

Step 4 - Moderate-to-Severe Persistent Asthma: Controller medication is a medium-dose ICS plus a LTRA (combination therapy). Alternatives include medium-dose ICS plus either a LTRA, theophylline, or zileuton.

Step 5 - Severe Persistent Asthma: Controller medication is a high-dose ICS plus LTRA.

Step 6 - Severe Persistent Asthma: Controller medication is a high-dose ICS plus a LTRA plus an oral corticosteroid (National Heart, Lung, and Blood Institute, May 2008).

Anti IgE: Omalizumab is indicated for moderate-to-severe persistent asthma in patients with a positive skin test and symptoms that are inadequately controlled with inhaled corticosteroids. However, it is given subcutaneously every (2-4) week. It determines the precise dose and frequency by total IgE level and body weight measured before starting therapy, and then periodically (Marcus, 2006)

Obesity

It is often defined as excess body weight rather than as excess body fat. BMI is calculated as weight in kilograms divided by the height in meters squared (Dietz, 1999; Keys, 1972). Healthy weight is defined as a BMI of 18.5 up to 24.9, overweight is defined as a BMI of 25 up to 29.9, and obesity is defined as a BMI of 30 or greater by the United States Dietary Guidelines (Dietary for Americans, 2005). Currently, it is estimated that 97 million adults in the United States are overweight (Flegal, 1998)

Relation between Asthma and Obesity

Both asthma and obesity are important health problems worldwide. Subsequently, their prevalence has widely increased over the past decade (Maalej, 2012). During the last 3 decades, the incidences of both obesity and asthma have shown a steady rise, with the incidence of asthma which has tripled more during this period (Flegal, 1998). Obesity could affect asthma in two ways. First, the release by adipocytes of various pro-inflammatory cytokines and mediators such as Interleukin 6(IL6) (Rowe, 2004). Furthermore, this could induce airway inflammation or increase its severity. Also, it will contribute to airway hyper-responsiveness. Second, the pressure of the increased tissue mass in the chest wall and abdomen has a direct mechanical effect on the lungs, which could modify airway hyper-responsiveness or could increase symptoms (Farah, 2012). So obesity can reduce lung compliance and lung volumes, and can disturb the ventilation-perfusion relationship (Juel, 2013)

Objectives

To determine the severity of asthma among studied groups, and to assess the relationship between the severity of asthma and BMI.

Patients and Method

Cross sectional descriptive study was conducted in Sulaimani Internal Teaching Hospital, and Allergy and Asthma center from January 2014 to April 2014. One hundred patients were included in this study. 66 were female and 34 were males. 67 patients were from Allergy and Asthma center, while 33 were from Internal Teaching Hospital. All patients had special questionnaire form filled with detailed socio-demographic information. Therefore, all of them had BMI calculated by the following equation: $BMI = \text{weight (kg)} / \text{height (m)}^2$. Patients were considered to be obese if BMI was equal or greater than 30 kg/m^2 , and over-weight if BMI of 25 is up to 29.9 (Marcus, 2006; Dietz, 1999; Keys, 1972)

Asthma severity was defined by using the criteria of the 2008 GINA guidelines. These guidelines categorize asthma severity into four categories based on clinical symptoms, physical activity, and pulmonary function test (FEV1 or PEF) (Maalej, 2012)

All had standard spirometry (Jaeger Tonnes, version 4.3, Medizintechnikmit system) and it was conducted in the respiratory laboratory by a trained respiratory technician on the day of the patient's visit.

Collected data were entered into excel sheet program. Data cleaning process were conducted for variables, and the data were then transferred to Statistical Package of Social Science (SPSS). SPSS software version 21 was used for all statistical analysis. In addition, P value <0.05 was considered to be significant.

Ethical Consideration

Scientific committee accepted selected topic. Also, official acceptance was taken from health authorities to conduct this study. Furthermore, the aim of study was made clear to all participants, and information collected was kept confidential.

Results

The mean age of the studied sample was 45 years old. However, the minimum age is 16 and the maximum age is 79 years old. Also, the mean of BMI was 29.07 with a maximum BMI of 57.5 and a minimum BMI of 16.7. Table 2. Age, duration of smoking, and BMI distribution of studied sample

Studied Variables	Minimum	Maximum	Mean	Std. Deviation
Age (Years)	16	79	45.0	15.53
Duration of smoking (Years)	1	30	13.0	8.78
BMI	16.7	57.5	29.07	6.73

Total numbers of the patients were 100 (34 males 66 females). 67% were inside the city, 69% were unemployed, nearly quarter of them had low income, 36% were illiterate, and 5% of them had university degree. Nearly half of them were never smoking and had no family history of asthma (Table 3).

Socio-demographic Characteristics	Frequencies	Percentages
Sex		
Male	34	34.0
Female	66	66.0
Total	100	100.0
Residence		
Inside city	67	67.0
Outside city	33	33.0
Total	100	100.0
Occupation		
Unemployed	69	69.0
Employed (Official)	31	31.0
Total	100	100.0
Income		
Good	29	29.0
Average	44	44.0
Low	27	27.0
Total	100	100.0
Educational level		
Illiterate	36	36.0
Primary	26	26.0
Secondary	14	14.0
Preparatory	11	11.0
Institute	8	8.0
University	5	5.0
Total	100	100.0
Smoking history		
Current	3	3.0
Ex-smoker	16	16.0
Social	7	7.0
Passive	20	20.0
Never	54	54.0
Total	100	100.0
Family history of Asthma		
Yes	37	37.0
No	55	55.0
Don't know	8	8.0
Total	100	100.0

Table 3. Socio-demographic characteristics of the studied sample

Nearly half of the studied group were reported as a severe persistent class of GINA classification, while minority were reported as remission class (2%) (Figure1).

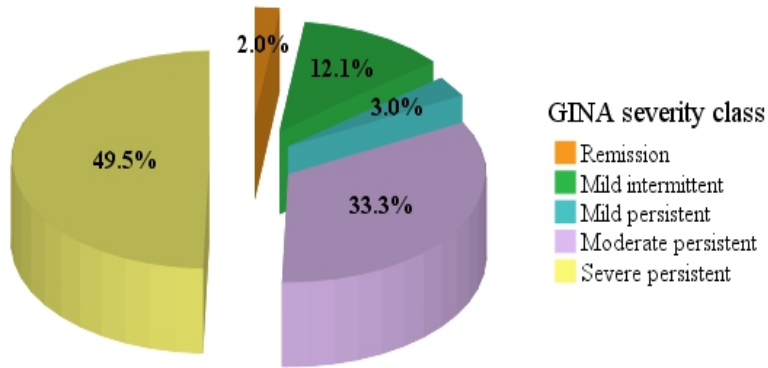


Figure 1. Frequency distribution of GINA class among studied sample

Approximately half of the studied samples were obese, quarter of them were over-weight, and only 2% were under weight (Figure 2).

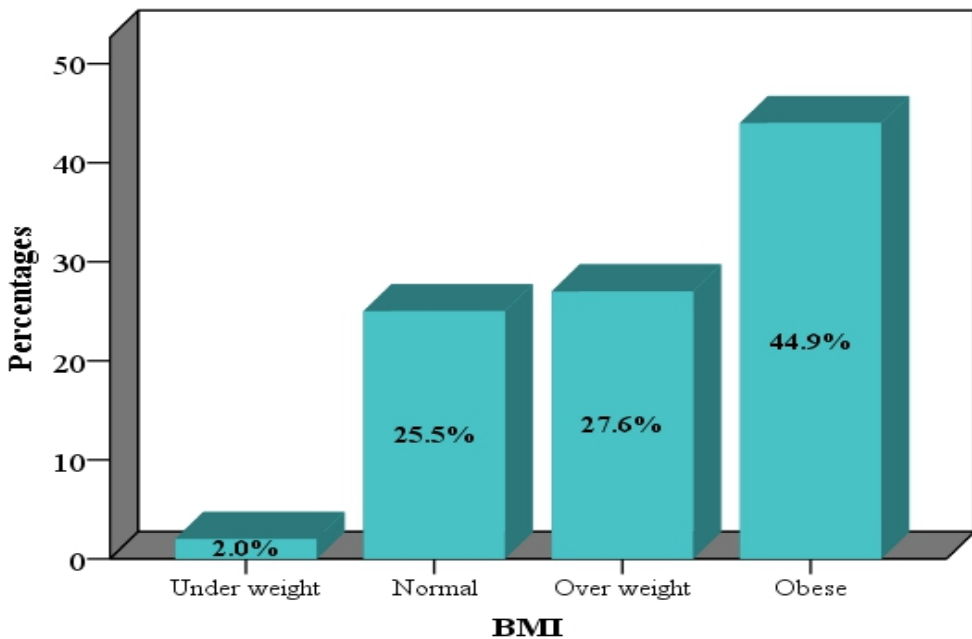


Figure 2. Frequency of different BMI groups among studied sample.

Approximately, 50% of the studied samples were allocated in severe persistent asthma (figure 1); 45% of the studied samples were obese (figure 2); and most of the obese patients were reported to have severe persistent asthma. There were two underweight patients among the studied sample (figure 2) which were also allocated to severe persistent class (figure 3).

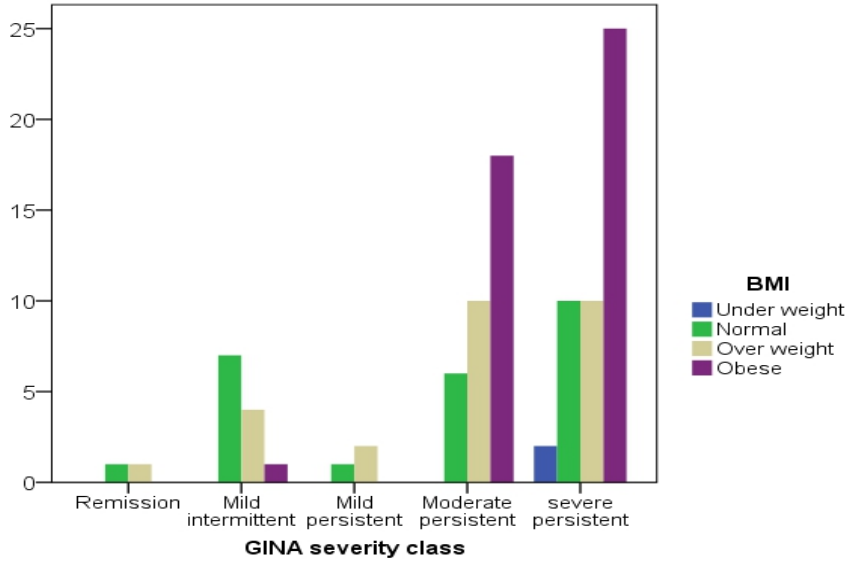


Figure 3. Frequency of BMI groups with GINA severity class

The mean \pm SD of BMI and GINA severity class of asthma were 28.8 ± 7.3 and 4.1 ± 1.1 , respectively. The spearman’s correlation coefficient analysis was carried out to test the relationship between BMI and GINA severity class of asthma. A positive correlation was found between BMI and GINA severity class of asthma ($r=0.252$). This positive correlation was statistically significant ($P<0.05$) as shown in Table (3) and figure (3). This relationship indicates that when the BMI increases, the GINA severity class of asthma will increase.

Table 4. Correlation between BMI and GINA severity class of asthma

	Spearman’s Correlation Coefficient	P Value
BMI	0.252	0.011
Asthma (GINA severity class)		

The scatter plot of asthma severity increased in the studied samples when the BMI increased (Figure 4).

According to regression analysis, the effect of BMI on GINA class was significant ($P=0.016$). The coefficient of the BMI effect was positive ($\beta=0.035$, 95% CI of $\beta=0.007$ to 0.064), indicating that the greater value of BMI are causing higher GINA severity class of asthma. The coefficient of BMI was 0.035. This means one value increase in BMI would result to a 3.5% increase in GINA severity class of asthma. Thus, this percentage of increase ranges from 0.7% to 6.4% (Table 5).

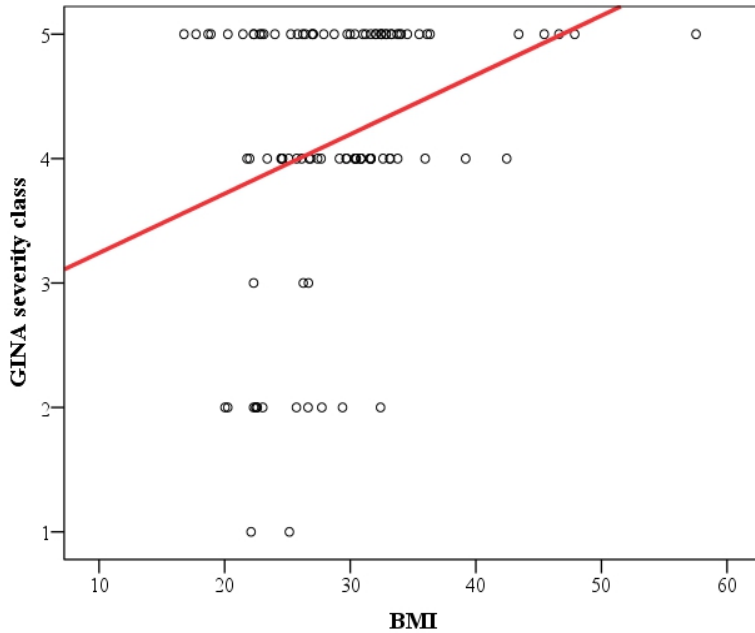


Figure 4. Scatter plot distributions of the correlation between BMI and GINA severity class.

Table 5. Regression analysis of BMI and GINA severity class of asthma

	Unstandardized Coefficients		Sig.	95.0% Confidence Interval for B	
	B	Std. Error		Lower	Upper
	BMI	0.035		.014	0.016

Discussion

In recent years, an increase in prevalence of both asthma and obesity has been observed. Many studies and trials have been conducted for this purpose. Hence, most of them suggested that there is a relationship between severity of asthma and obesity. The present study had evaluated the impact of obesity on asthma and has demonstrated a positive correlation. That is to say that obesity increases severity of asthma. This positive correlation was statistically significant (p=0.011). Therefore, one value increase in BMI would result to a 3.5% increase in GINA severity class. A possible explanation for that positive correlation is that both obesity and asthma can cause excessive small airway obstruction which increase asthma severity in those with high BMI. Majority of the obese patients were allocated in severe persistent asthma class, and the two under-weight patients included in the studied samples were also allocated in severe persistent asthma.

Consequently, this may be explained by other factors that influence the severity of asthma other than obesity.

Many studies up till date had demonstrated an association between obesity and increased asthma severity in adults (Akerman, 2004; Saint-Pierre, 2006; Varraso, 2005). They demonstrated an increased likelihood of obesity among adults with both moderate and severe persistent asthma compared with adults with mild intermittent asthma (Akerman, 2004). Similarly, Saint-Pierre et al demonstrated that patients with severe persistent asthma were more likely to be overweight (defined as BMI >25) compared with those with mild persistent and moderate persistent asthma (Saint-Pierre, 2006)

Subsequently, other studies have failed to demonstrate associations between obesity and asthma severity (de Marco et al., 2006; Conley-Thomson, 2003; Chinn, 2002). Hence, they showed no difference in baseline BMI across asthma severity groups using GINA severity classification (de Marco et al., 2006).

Moreover, Conley-Thomson C et al and Chinn S et al revealed no significant sex differences in the relationship between BMI and asthma severity (Conley-Thomson, 2003; Chinn, 2002). Other studies found that this association was significant among women but not among men (Juniper, 1999; Chanez, 2006; Dixon, 2006).

Consistent with this present study, Mosen et al found that smoking had no significant value (Mosen, 2008). Also, Maalej S. et al showed that obese smokers were significantly more likely to have a more severe asthma (Maalej, 2012).

Also, similar finding of this present study was observed in a study conducted by B Taylor et al. Thus, their study found no significant value of positive family history of asthma with BMI and severity class ($p= 0.92$) (Taylor, 2008).

Conclusion

- ❖ This study confirmed that the severity of asthma increases with rising in the prevalence of obesity in adult patients.
- ❖ Age and sex were not associated with asthma severity and BMI.
- ❖ Smoking had no significant effect on the relation of asthma severity and BMI.

References:

Global asthma day: Global Strategy for Asthma Management and Prevention Media Backgrounder (May 2014). Retrieved from http://www.ginasthma.org/local/uploads/content/files/Strategy_Backgrounder.pdf.

- Burrows, B., Barbee, R.A., Cline, M.G., Knudson, R. J., and Lebowitz, M. D. (1999). Characteristics of asthma among elderly adults in a sample of the general population. *Chest*, 100(4), 935-42.
- Masoli, M., Fabian, D., Holt, S., and Beasley, R. (2004). Global Initiative for Asthma (GINA) Program: The global burden of asthma: executive summary of the GINA Dissemination Committee report. *Allergy*, 59(5),469-478.
- National Heart, Lung, and Blood Institute. (May 2008). Global Strategy for Asthma Management and Prevention. Retrieved from <http://emedicine.medscape.com/article/296301-overview#aw2aab6b2b4>.
- Gjevre, J.A. ,Hurst, T.S., Taylor-Gjevre, R.M., and Cockcroft, D.W. (2006). The American Thoracic Society's spirometric criteria alone is inadequate in asthma diagnosis. *Can Respir J* , 13(8), 433–37.
- Holohan, J., Mannig, P. , and Nolon, D. (2012). Asthma control in general practice: Adopted from the GINA global strategy for asthma management and prevention. 2nded. Quality in practice committee; 1-15
- Maalej, S., Yaacoub, Z., Fakhfekh, R., Yaalaoui, S., Kheder, A., and Drira, I. (2012). Association of Obesity with Asthma Severity, Control and Quality of life. *Tanaffos* , 11(1), 38-43.
- Global Strategy for Asthma Management and Prevention, Global Initiative for Asthma (GINA) (2014). Retrieved from <http://www.ginasthma.org> .
- Rowe, B.H., Edmonds, M.L., Spooner, C.H., Diner, B., and Camargo, C.A. (2004). Corticosteroid therapy for acute asthma. *Respir Med* , 98(4), 275-84.
- Expert Panel Report: Guidelines for the Diagnosis and Management of Asthma-Summary Report (2007). *J Allergy ClinImmunol*, 120(5Suppl), S94-138. Retrieved from <http://www.nhlbi.nih.gov/guidelines/asthma/asthsumm.pdf>.
- Global Strategy for Asthma Management and Prevention, Global Initiative for Asthma (GINA) (2010). Retrieved from <http://www.ginasthma.org>.
- Berridge, M.S., Lee, Z., and Heald, D, L. (2000). Pulmonary distribution and kinetics of inhaled [¹¹C] triamcinoloneacetone. *J Nucl Med* , 41(10), 1603-11.
- Nelson, H.S. (2001). Combination treatment with fluticasone propionate/salmeterol the treatment of asthma. *J Allergy ClinImmunol*, 107(2), 398-416.
- Marcus, P.(2006). Incorporating anti-IgE (omalizumab) therapy into pulmonary medicine practice: practice management implication. *Chest*, 129, 466-74.
- Dietz, W.H., and Robinson, T.N. (1998). Use of the body mass index (BMI) as a measure of overweight in children and adolescents. *J Pediatr* , 132, 191–93.

- Keys, A., Fidanza, F., Karvonen, M.J., Kimura, N., and Taylor, H.L. (1972). Indices of relative weight and obesity. *J Chronic Dis* , 25, 329–43.
- U.S. Department of Health and Human Services and U.S. Department of Agriculture. *Dietary for Americans* (2005). Retrieved from: <http://www.health.gov/dietaryguidelines/>.
- Flegal, K.M., Carroll, M.D., Kuczmarski, R.J., and Johnson, C.L. (1998). Overweight and obesity in the United States: prevalence and trends, 1960–1994. *IntObesRelatMetabDisord* , 22(1), 39-47.
- From the Global Strategy for Asthma Management and Prevention, Global Initiative for Asthma (GINA). (2011) . Retrieved from <http://www.ginasthma.org>.
- Farah, C.S., and Salome, C.M. (2012). Asthma and obesity: A known association but unknown mechanism. *Respirology*, 17, 412–21.
- Juel, C.T. , and Ulrik, C.S. (2013). Obesity and Asthma: Imp 21. JuelCT ,Ulrik CS. Obesity and Asthma: Impact on Severity Asthma Control, and Response to Therapy. *Respiratory care* , 58, 867-71.
- Akerman, M.J., Calacanis, C.M., and Madsen, M.K. (2004). Relationship between asthma severity and obesity. *J Asthma* , 41, 521–6.
- Saint-Pierre, P., Bourdin, A., Chanez, P., Daures, J.P., and Godard, P. (2006). Are overweight asthmatics more difficult to control?. *Allergy* , 61, 79–84.
- Varraso, R., Siroux, V., Maccario, Pin, I., Kauffmann, F. (2005). Asthma severity is associated with body mass index and early menarche in women. *Am J RespirCrit Care ed* , 171, 334–9.
- de Marco, R., Marcon A, Jarvis D, Accordini, S., Almar, E., Bugiani, M., Janson,S. (2006). Prognostic factors of asthma severity: a 9- year international prospective cohort study. *J Allergy ClinImmunol*, 117, 1249–56.
- Conley-Thomson, C., Clark, S., and Carmago, C.A. (2003). Body mass index and asthma severity among adults presenting to the emergency department. *Chest*, 124, 795–802.
- Chinn, S., Jarvis, P., and Burney, P. (2002). Relation of bronchial responsiveness to body mass index in the ECRHS. *Thorax*, 57, 1028–33.
- Juniper, E.F., O'Byrne, P.M., Guyatt, G.H., Ferrie, P.J., and Kin, D.R. (1999). Development and validation of a questionnaire to measure asthma control. *EurRespir J*, 14 (4), 902- 7.
- Chanez, P., Varin, P., Bourdin, A. (2006). Body mass index (BMI) discriminates patients with severe asthma. *Proc Am ThoracSoc*, 3, A790.
- Dixon, A.E., Shade, D.M., Cohen, R.I., Skloot, G.S., Holbrook, J.T., ...Smith, L.J. (2006). Effect of obesity on clinical presentation and response to treatment in asthma. *J Asthma*, 43 (7), 553-58.

Mosen, D., Schatz, M., Majid, D., Camargo Jr, C. (2008). The relationship between obesity and asthma severity and control in adults. *J Allergy ClinImmunol*, 122(3), 507-511.

32. Taylor, B., Mannino, D., Brown, C., Crocker, D., Twum-Baah, N., and Holguin, F. (2008). Body mass index and asthma severity in the National Asthma Survey. *Thorax*, 63, 14-20